REMARKS

Applicant respectfully traverses the 35 U.S.C. § 102(b) rejection of claims 1,3, and 5 over Munz, and the 35 U.S.C. § 103(a) rejection of claims 4 and 11 over Munz.

Among other features, the present invention has a micro-rough layer having a particle diameter of 10 to 30 μm. The advantages of this particle diameter are disclosed, *e.g.*, at paragraph 12 of the specification. In addition, as set forth in amended claim 1, the micro-rough layer has an average height of roughness of 0.01 to 0.06 mm, a thickness of 10 to 40 mm, a hardness of 100 to 1100 HV, and a surface roughness of 10 to 30 μmRy.

The Examiner, relying on a version of Munz printed in German, stated that Munz discloses a micro-rough layer of 10 to 30 mm. Applicant's counsel neither reads nor speaks German. However, enclosed with this Amendment is an English translation of Munz, disclosing the details of the micro-rough layer of Munz, *e.g.*, at page 2, lines 6-15 of the translation. As is evident from the partial English translation, Munz neither discloses nor suggests all of the features of the micro-rough layer recited in claim 1, including, *e.g.*, the recited values of particle diameter. At least for this reason, Munz neither anticipates nor renders obvious the present invention as set forth in the claims.

Entry of this Amendment after Final is proper in order to place this case in condition for allowance. Alternatively, withdrawal of the restricted claims 6-10 and 12, and cancellation of claims 2 and 11 reduces the number of claims pending in the case, thereby placing this case in better form for appeal.

Applicant respectfully requests entry of this Amendment After Final Action, and favorable reconsideration and allowance of claim 1 and 3-5.

Please grant any extensions of time required to enter this response and charge any additional required fees to our deposit account 06-0916.

Respectfully submitted,

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Attachment: English translation of DE 199 38 452

English translation of DE 199 38 452 A1

Description

The invention relates to a moulding tool, in particular to a multi-sectional drawing tool, according the preamble of claim 1.

It is known for forming sheet metal components in automotive engeneering to use drawing tools made of cast iron, which have a long lifetime typically in the amount of 0,5 millions. In providing such cast iron tools with a chromium coating it is possible to nearly double the useful life. However, such moulding tools are costly in manufacturing.

However, drawing tools made of fine zinc alloys (Zamak) are much more cost-saving, but they have a noticeably shorter lifetime and are thus applicable only in the field of prototypes with quantities – depending on the type of sheet metal – of a few hundred pieces.

Hence, there is a continuing need for a moulding tool that can be manufactured in a cost-saving manner for the sector of medium quantities, i.e. for quantities of up to more than 10 000 formed parts, as used in automotive engineering for special designs or niche cars.

Therefore it is an object of the present invention to create a moulding tool of the aforementioned type, which can be manufactured in a cost-efficient manner but still exhibits a sufficiently high stability in the sector of medium quantities.

In order to attain the abovementioned object, a moulding tool according to claim 1 is provided.

According to the present invention the stability of a moulding tool consisting of a fine zinc alloy is increased in an considerable amount, namely at least 10fold, in using

the claimed combination of materials with a chromium surface coating, even if the layer thickness of the surface coating is only a few µm, so that even sheets of higher strenght can be formed offhand with only a single drawing tool in the sector of medium quantities, whereas the tool costs are lower than the costs for the usually required Zamak-tools or other comparable cast iron tools used in this size of series.

Most preferred with respect of manufacturing according to claim 2 is a galvanizing process for applying the surface coating, namely according to claim 3, prefered in a thickness of 10 µm to 15 µm.

For reasons of an increased wear resistance the surface coating contains, according to claim 4, preferably a content of 90% of pure chromium, whereby a degree of hardness of 70 Rockwell can be obtained.

In another particularly preferred embodiment of the present invention the required lubricant for a qualitative high-grade forming process is reduced, since the surface coating according to claim 5 has a micro-coarse surface structure or is, according to claim 6, provided with a solid material slide layer.

The invention is now further described in detail by means of an embodiment in connection with the figure.

The application shows in it's only figure a highly schematic view of a section of a drawing press including a multi-sectional drawing tool for forming a pre-cut part sheet metal.

The drawing tool, as shown in the figure in it's opened state, is used for non-cutting forming of high strenght sheet steel or aluminium sheet metals and comprises as major components a lower tool **2** with a press cushion **4** that is movable upwards and downwards and supports the clamp sheets **6**, and a press table **8** which is arranged opposite to the press cushion in a linearly lift-displacable manner and on which the

punch **10** is installed, and an upper tool **12** with the tool plate **14** and an ejector **16**. Insofar the drawing tool is of a type normally used.

To produce the parts **6, 10** and **14** of the drawing tool, which are afflicted with wear, in a cost saving manner in the process of forming sheet metals in the sector of – from the point of view of the automotive engineering - medium quantities, i.e. with a lifetime between 1000 and 20000, depending on the type of sheet metal, these parts of tools **6, 10** and **14** are made of a fine zinc alloy (Zamak) as basis material and are supplied after profile milling and grazing with a chromium surface coating **18**, which is applied by a galvanizing method with a layer thickness of 10 µm to 15 µm and contains more than 99 % pure chromium. Thus a surface degree of hardness above 70 Rockwell can be obtained. The process of surface coating is adapted in such a manner that a micro-fine roughened surface structure is produced, thereby increasing the adhesive strengh of the lubricants resulting in an improvement of lifetimeand forming behaviour of the drawing tool **6, 10** and **14**. To further reduce the required lubricants the galvanic surface coating can additionally be provided with a solid material slide layer **20** based on sulfide or selenide which is atmospherically sputtered or applied with means of vacuum deposition on the galvanic layer 18.

The invention is not solely applicable on drawing tools, but also on other moulding tools, for instance on injection moulding tools or pressure casting tools in lower temperature ranges up to about 200°C.

Claims

1. Moulding tool, in particular a multi-sectional drawing tool, consisting of a fine zinc alloy (Zamak), characterized in that the moulding tool **(6, 10, 14)** is provided with a surface coating **(18)** of a material containing chromium applied on the Zamak material.

2. Moulding tool according to claim 1, characterized in that the surface coating **(18)** is applied by a galvanizing process.

3. Moulding tool according to claim 1 or 2, characterized in that the layer thickness is between 10 and 15 µm.

4. Moulding tool according to any one of the preceding claims, characterized in that the surface coating **(18)** has a content of more than 90 % of pure chromium.

5. Moulding tool according to any one of the preceding claims, characterized in that the surface coating **(18)** has a micro-coarse surface structure.

6. Moulding tool according to any one of the preceding claims, characterized in having an additional coating of a solid material slide layer **(20)** applied on the surface coating **(18)**.

Hereunto 1 page(s) drawings
